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How Exposure to Markets Can Favor Inequity-Averse Preferences

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Abstract

This paper shows how non-individualistic preferences can be individual fitness maximizing in the presence of general equilibrium externalities. In the model, individuals share an endowment, which can be consumed on its own and/or used as a means of exchange to purchase goods from merchants on the external market if such exists. Assuming that increased consumption means increased individual fitness, we show that inequity-averse behavior with respect to endowment distribution can be an optimal response to merchants' price discrimination and lead to the evolution of inequity-averse preferences. The findings presented here are supported by empirical evidence on the endogeniety of people's preferences with respect to exposure to market exchange.

1 Introduction

Vast empirical evidence on people sharing money shows that people seem to care, alongside their own pecuniary interest, about the well-being of other parties affected (for a comprehensive review, see Fehr & Schmidt (2006)). Furthermore, cross-country studies not only proved the ubiquity of other-regarding preferences but also showed that people's revealed preference for inequity aversion takes, with small deviations, a very similar form across different countries (see, e.g., Roth *et al.* (1991)). This eventually led to the thought that other-regarding preferences can be more characteristic of human nature than selfish ones (see Fehr & Schmidt (1999); Bolton & Ockenfels (2000); Charness & Rabin (2002) for popular representations of such preferences). However, as argued in Henrich

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(2000), the latter finding and conclusion need to be restricted only to modern industrialized societies. Henrich (2000)—a study on the economic behavior of the Machiguenga Indians of the Peruvian Amazon—shows that the preferences of Machiguenga Indians revealed in experiments are rather own-regarding than other-regarding, setting forth again the question about the foundations of human behavior and sociality observed in modern societies.

In order to see if the finding of Henrich (2000) constitutes a phenomenon beyond the society studied, a large project was initiated to obtain more evidence on indigenous people's economic behavior from different small-scale traditional societies around the world. Arguably, by studying traditional societies it allows us to look at modern people's preferences as of an early stage of social cohabiting—the foundations of human sociality—and the further evolution of those preferences. This project, documented in Henrich *et al.* (2001) and Henrich *et al.* (2004), consisted of carrying out economic experiments with members of the traditional societies studied, and one of its main findings is the existence of several between-group differences in people's revealed amount of sociality. One of the discovered differences, which is going to be the object of this paper, is that members of a market-integrated society (as measured, primarily, by the society's exposure to market exchange) behave on average more pro-socially (i.e., share more with others) than do members of an isolated society. To put it differently, the appearance of people's revealed preferences seems to be influenced by the socioeconomic environment they live in. As such, the appearance of preferences observed may not perfectly reveal people's intrinsic nature and their "true" preferences (of which people can be ignorant themselves).[1] Henrich *et al.* (2004, p.50–51) leave open the question of what explains the discovered empirical pattern, calling for more research on this important finding, and the current paper attempts to contribute toward a better understanding of this.

In this paper, we offer an evolutionary argument for the endogeneity of people's preferences documented in Henrich *et al.* (2004). In particular, we present a model in which a society's exposure to market exchange can favor the evolution of inequity-averse preferences for money distribution, whereas selfish preferences prevail in isolated societies. The main idea is that in a society with market exchange inequity aversion with respect to money distribution can attenuate the scope of merchants' price discrimination and, subsequently, improve terms of trade with merchants ultimately leading to higher consumption levels of the society's members. Then, assuming that increased consumption means increased individual fitness (reproductive success), inequity-averse preferences for

[1] Among other evidence on the endogeneity of people's preferences, Buchan *et al.* (2002) document cross-cultural differences in people's propensity to trust and reciprocate. Herrmann *et al.* (2008) report a cross-societal variation in people's pro- and anti-social punishment behavior revealed in public goods experiments and link this variation to differences in norms of civic cooperation and the importance of the rule of law across countries. Bowles (1998) offers a systematic review of related theoretical and empirical literature.

money distribution can be individual fitness (i.e., own consumption) maximizing and eventually be favored by natural or rather cultural selection (through enculturation).

As a simple example, illustrating the main idea of the paper, consider an extended two-player dictator game with consumption. Let the dictator be randomly chosen from the two identical players (individuals) to split a monetary endowment of size 1 given exogenously. Suppose that the endowment distribution resulting from a split is public information, but the players' individual endowment shares are their private information. An individual's utility from his own endowment share is measured in the number of the units consumed of the only non-divisible good available on the external market that the individual's share can afford. On the external market, there is a monopolist producer, who produces the good at some constant marginal cost of, say, $c = 0.1$. After learning about the endowment distribution, the producer charges the price for a unit of the good that maximizes her profits from following simultaneous trades with the two individuals. Within the setting described, we raise the question of what is the optimal sharing rule maximizing the dictator's consumption? Obviously, it is not optimal for the dictator to keep all the endowment for himself. Because if he does so, the producer targets only the rich individual, i.e., the dictator, by setting the price equal to the size of the endowment, i.e., to 1, leaving the dictator with only one unit of the good consumed. Instead, the dictator could increase his consumption by giving the other individual a portion of the endowment large enough to make the profit-maximizing producer set the price aimed at both individuals, which would leave the richer one—the dictator—with some consumer surplus (or rather information rent) and more units consumed. (In our example, if the dictator gives the other individual 1/3 keeping 2/3 of the endowment for himself, then the producer finds it optimal to set the price equal to 1/3, and the dictator enjoys two units consumed.) Hence, from a conventional utility function for consumption we obtain a non-monotonic indirect utility function of money, which can be interpreted as having underlying inequity-averse preferences for money distribution. The intuition behind this result is that by sharing with others one can acquire information rent and, consequently, increase the purchasing power of one's own, even diminished, share.

In the paper, we develop the above idea into a formal model with evolution of preferences. The essential feature of the model is that we measure evolutionary fitness *not* in terms of monetary returns, which are the direct object of people's decision making, but in terms of the consumption that those monetary returns can later afford. More precisely, in our model individuals possess *subjective* preferences for money distribution, which they maximize when they need to share money (an endowment in the model). But individuals' *objective* payoffs, or their objective utility with underlying "objective preferences", stem from the consumption levels that their own money shares—resulted from their actions (dictated, respectively, by their subjective preferences)—lead to. Then, we raise the question what subjective preferences generate the highest objective payoffs and, correspondingly, survive evolutionary pressures.[2] As we show, because of general equilibrium externalities ensuing from a society's exposure to market exchange, inequity-averse preferences for money distribution can render a higher consumption level than that rendered by individualistic preferences and, correspondingly, the former are favored by natural or cultural selection.

We use an evolutionary approach in order to relax the rationality assumption *à la* "homo economicus" and allow individuals to maximize their subjective preferences rather than their objective preferences, which, nevertheless, determine the players' reproduction success. While we adopt the "indirect" evolutionary approach (see Güth & Yaari (1992); Ely & Yilankaya (2001)), when showing that the equilibrium play of the game in question is evolutionary stable, the standard approach (Weibull (1995)) would render the same results, too. In fact, in our setting the two approaches are interchangeable, allowing us to relate the findings obtained with the literature on both approaches.

This paper also contributes to the evolutionary literature by providing a distinct and empirically supported argument on how non-individualistic preferences in the individual selection framework may survive evolutionary pressures. Typically, evolutionary models in favor of non-individualistic preferences have required either a group-selection argument in the standard approach (for a review, see Bergstrom (2002)) or certain informational assumptions about the observability of the players' preferences in the "indirect" approach (for a concrete example, see Bester & Güth (1998); for a more general argument, see Dekel *et al.* (2007)). This paper, however, bypasses all of the above: the result primarily hinges on general equilibrium effects.[3] Therefore, this paper instead falls into the "game of life" paradigm, arguing that people's behavior should be examined in a wider social context (see Binmore (1994, 1998); or Güth & Napel (2006) for an example related to the evolution of inequity-averse preferences).

The remainder of the paper is organized as follows. Section 2 expands the example given above into a more general model and solves it. Section 3 discusses the results obtained, links them to empirical studies, and offers possible extensions. The last section concludes the study.

[2] In a similar fashion, Huck & Oechssler (1999) develop an evolutionary argument for revengeful behavior presuming that the individual subjective payoff and subsequent evolutionary fitness resulting from strategies employed are not equivalent. The general models of evolution of preferences (see Ely & Yilankaya (2001); Ok & Vega-Redondo (2001); Dekel *et al.* (2007)) also differentiate between people's subjective and objective preferences.

[3] Certainly, this paper is not unique in showing how individual selection can favor pro-social preferences. For instance, Becker (1976) presents a model in which egoists take actions as though they had altruistic preferences in order to benefit from others' altruism.

2 Model

2.1 Framework

Suppose that the land rewards a group of farmers with a publicly observed harvest surplus, henceforth, the endowment S, which the farmers share among themselves. If used for own consumption, an endowment share $s \in [0, S]$ renders a farmer the material payoff of $U^0(s)$, $U^0_s > 0$, $U^0_{ss} < 0$. In the event the group is exposed to external trades, endowment shares can also be used as a means of exchange, i.e., as money, to purchase goods from merchants. It is assumed that every farmer has a demand for at most one unit of external goods, and that the endowment distribution within the group, ensuing after an endowment split, is public information, while individual shares are only privately known.[4]

Suppose that merchants can offer one type of goods—"the good"—which, on the other hand, can be produced in various quality q, greater than or equal to some $\underline{q} > 0$[5], with the production function $C(q), C_q > 0, C_{qq} > 0$, and the returns to scale from producing a given variety being constant. The merchants offer the farmers a menu of price-quality (p, q) bundles of the good to choose from, where the price p is gauged in terms of the endowment. When offering bundles of the good, the merchants aim to maximize their expected profits (returns less production costs), and for that they take into account the income distribution observed within the group, farmers' unit demand, and market competition, described more precisely below.

The consumption of a (p, q) variety of the good and of the remainder of an endowment share s renders a farmer the material payoff of $U^G(s - p, q), U^G_1 > 0, U^G_{11} < 0, U^G_2 > 0, U^G_{22} < 0, U^G_{12} > 0$. A farmer will consider purchasing a variety (p, q) only if it results in a non-negative net utility level U, defined as $U(q, s, p) \equiv U^G(s - p, q) - U^0(s)$ with its properties being $U_s > 0, U_{ss} < 0, U_q > 0, U_{qq} < 0$, and $U_{qs} > 0$.[6] Furthermore, given a menu of price-quality bundles, farmers are assumed to choose the bundle, if any, that maximizes their net utility U. For analytical convenience, let the function U be of the

[4] In the framework described, the "farmers" are chosen to allude to the historical division of labor into farmers, nomads, and merchants, which could potentially serve as a "real life" example in the subsequent argument about the evolution of inequity-averse preferences for money distribution. In addition, with "farmer" economy it is intended to refer to the traditional societies in Henrich *et al.* (2004), from which comes the empirical support for the results of the model.

[5] This condition is for modeling purposes only and is made to have well defined consumption bundles in further analysis.

[6] All the listed properties of the utility function U are related to consumer preferences for normal goods (as in, e.g., Mas-Colell *et al.* (1995)). In particular, the positive partial derivative U_s implies that a richer individual derives a higher utility from the consumption of the good (due to, say, smaller opportunity costs). Similarly, the positive cross derivative U_{qs} can be interpreted as meaning that a richer consumer values quality more, which can be motivated by the convexity of the Engel curves for high-quality goods.

quasi-linear form in the price p :

$$U(q,s,p) = V(q,s) - p, \tag{1}$$

but the numerical example following the analytical part considers a more general case.

Finally, we consider three different scenarios of the external market structure: 1) merchants are absent (the farmers' economy is autarkic), 2) monopoly (there is a monopolist merchant), and 3) perfect competition (there are many competing merchants).

2.2 Game and natural selection

Along the lines of the above framework, consider a large population of farmers randomly and repeatedly (after the endowment is consumed) matched into separate groups of two farmers, and every group is endowed with the same-size endowment S. In a group, Nature randomly selects a farmer to be the "dictator," who is to divide the endowment into shares $s \in [0, S]$ for himself and $(S - s)$ for the other farmer at own discretion.[7] Suppose that farmers have subjective preferences for endowment distribution (or money distribution), characterized by the subjective utility function U^S with preference type $\tilde{s} \in [0, S]$ such that the (subjective) utility from an endowment share s, accrued to a farmer with a preference type $\tilde{s}$, is

$$U^S(s, \tilde{s}) = -|s - \tilde{s}|. \tag{2}$$

Therefore, in what follows, a farmer of preference type $\tilde{s}$, when selected to be the dictator, always keeps $\tilde{s}$ for himself, leaving $S - \tilde{s}$ for the other farmer in the match.[8] Next, suppose that in the population subjective preference types are initially distributed according to some non-degenerate distribution over the whole type space $[0, S]$.

The objective payoffs from a split, or the evolutionary fitness, are measured by the resulting material payoffs U^0 or U^G, which, on the other hand, depend both on the own-endowment share and on the menu of consumption bundles offered on the external market. The farmers, however, cannot discern for themselves what material payoffs their actions over endowment split result in. Instead, they can be thought of as living behind the "veil of ignorance" about external markets or about what "global game" they are part of, and, therefore, they just divide the endowment according to their subjective

[7] As for the endowment sharing rule, we adopt the dictator-game framework, which is done mainly for modeling convenience; the main results are also robust against other modeling frameworks, e.g., that of the ultimatum game. What matters in the end is the presence of general equilibrium effects.

[8] While we are following the "indirect" evolutionary approach (Güth & Yaari (1992) and Ely & Yilankaya (2001)), alternatively, we could think of the farmers as being pre-programmed to split the endowment according to their preference types as in standard evolutionary models, see Weibull (1995). Due to the specificity of the game studied, the two approaches would render identical results, which is not necessarily the case in general (e.g., Huck & Oechssler (1999)).

preferences only. Significantly, knowledge of other farmers' preferences or the population distribution of preferences will not play any role in this game, although that is not generally the case (see, e.g., Ok & Vega-Redondo (2001) or Dekel *et al.* (2007)). Next, for modeling convenience, merchants are assumed to design consumption bundles for every match separately, and these bundles are not available to the farmers from other matches. With merchants assumed to design bundles in the profit maximizing way and farmers assumed to choose the own-utility-maximizing one, this sequential structure of the model allows us to "prune" the production and consumption stages and to consider the reduced game only, i.e., the dictator game, where the external market structure and merchants' optimal play are embodied in the farmers' material payoff function.

As already specified above, we distinguish three cases of merchants' market: autarky, the monopolist market, and the perfectly competitive market—each giving rise to a distinct farmer material payoff function—and we analyze the three cases in three different games Γ^A, Γ^M, and Γ^C, respectively. In each game, there are two players (two farmers), their action space is to choose an endowment share $s \in [0, S]$ for himself, leaving the other player $S - s$. Each player has subjective preferences over an endowment split $(s, S-s)$, characterized by his subjective parameter $\tilde{s} \in [0, S]$ and the utility function U^S defined in (2), which he maximizes when selected to divide the endowment into shares. But at the same time, the players' material payoffs (evolutionary fitness) stemming from their actions are measured in the utility levels U^0 or U^G resulting from the affordable consumption that their actions lead to, as will be precisely defined below for each game separately.

Then, for each game we tackle the question of what subjective preferences yield the greatest material payoffs and, accordingly, will be favored by natural selection, with their population share increasing at the expense of other less successful preferences. We adopt the "indirect" evolutionary approach with a static stability concept of equilibrium so that in equilibrium no mutation can give a higher (material) payoff than that of the incumbent types. Based on the results of Ely & Yilankaya (2001) and applying them to our games studied, evolution selects those subjective preferences or, equivalently, actions over an endowment split that constitute an equilibrium of the game in question defined in terms of expected material payoffs. And we call those subjective preferences evolutionary stable.[9] In what follows, by an equilibrium of a game we mean an equilibrium in material payoffs.

[9]Ely & Yilankaya (2001) studies finite games, while in our model the action space is allowed to be infinite: $s \in [0, S]$. However, since we design our games in such a way that the existence of equilibrium is not an issue, then the results of Ely & Yilankaya (2001) apply to our setting as well despite a continuous action space. Alternatively, we could make our games studied finite by simply discretizing the players' action and preference spaces, and then the results of Ely & Yilankaya (2001) would apply directly.

2.3 Equilibrium play in a match

Case 1: Autarky

Consider game Γ^A, where the farmers are not exposed to any external trades, making it a standard two-player dictator game. The material payoff from an endowment share s is $U^0(s)$; given the optimal play of the players (with respect to their subjective preferences), the expected material payoff to a farmer of preference type $\tilde{s}$ when matched with a farmer of preference type $\tilde{s}'$ is

$$\pi^A(\tilde{s}, \tilde{s}') = 0.5U^0(\tilde{s}) + 0.5U^0(S - \tilde{s}').$$

More generally, given a population distribution of subjective preferences F, the expected material payoff in population (evolutionary fitness) to a farmer of preference type $\tilde{s}$ is defined as

$$\Pi^A(\tilde{s}) = 0.5U^0(\tilde{s}) + 0.5E_{\tilde{s}' \in C(F)}U^0(S - \tilde{s}'),$$

where $C(F)$ is the support of the distribution F, and E is the expectations operator.

Since the second term of the above fitness expression does not depend on the own-preference type, the farmers of type $\tilde{s} = S$ attain the highest fitness because of $U^0_s > 0$. Hence, the equilibrium of game Γ^A (the evolutionary stable strategy profile) is to keep the whole endowment—resulting in the endowment split $(S, 0)$—which implies that in autarky selfish types ($\tilde{s} = S$) would prevail.

Case 2: Monopoly

In game Γ^M, in order to specify the players' material payoffs from their actions, first, we need to solve for the optimal consumption bundles offered by the monopolist profit-maximizing merchant given endowment distribution. From the merchant's perspective, it is a mechanism design problem with hidden information, for a potential customer's wealth, i.e., his endowment share, is his private information. Once the menu of bundles is set, it is not subject to change, by which we rule out the possibility of the merchant's updating her beliefs about prospective buyers' wealth distribution after some trade has taken place (alternatively, we could assume that at the last stage only one trade with a random farmer takes place). The exposition of the merchant's problem closely follows Mussa & Rosen (1978).

Merchant's problem

After the endowment in a match is divided between the two farmers, the merchant learns about the ensuing endowment shares s_1 and s_2, $s_1 \leq s_2$, and, accordingly, maximizes her expected profit $0.5(p_1 - C(q_1)) + 0.5(p_2 - C(q_2))$ with respect to price-quality bundles of the good $\{(p_1, q_1), (p_2, q_2)\}$, where the second bundle is aimed at the richer farmer (and the assumption is that every farmer has a demand for at most one unit of the good). There is no need to state the problem and solve it formally, for the solution to this type of problem is well established in the contract theory literature once specific conditions are met (such as the single-crossing property, which in our model is ensured by the assumption of the positive cross derivative of net utility function U, $U_{qs} > 0$). Hence, below we immediately proceed with describing the results for various scenarios of endowment split.

In the special case of the equal endowment split $s_1 = s_2 = S/2$, the merchant offers one price-quality allocation $(p_1, q_1) = (p_2, q_2) = (p, q)$ such that

$$C_q(q) = V_q(q, s_2), \tag{3}$$

$$p = V(q, s_2), \tag{4}$$

which coincides with the first-best allocation under symmetric information, where consumers are left with no consumer surplus.

For an uneven split, $s_1 < s_2$, two cases need to be distinguished depending on what the merchant finds optimal: 1) to serve both farmers and 2) to ignore the poorer farmer and serve only the richer farmer. When the merchant serves both farmers, the optimal price-quality bundles (p_1, q_1) and (p_2, q_2) are found from

$$C_q(q_2) = V_q(q_2, s_2), \tag{5}$$

$$C_q(q_1) = 2V_q(q_1, s_1) - V_q(q_1, s_2), \tag{6}$$

for the quantities q_1 and q_2; and the prices follow from

$$U(q_1, s_1, p_1) = 0,$$

$$U(q_2, s_2, p_2) = U(q_1, s_2, p_1),$$

where the last two expressions are the binding individual rationality constraint of the poorer type (s_1) and incentive compatibility constraint of the richer type (s_2), respectively. In this case, the richer farmer enjoys the information rent of size $U(q_2, s_2, p_2)$, while the poorer one is left with none. The condition for both farmers to be served is that the quality q_1 from (6) needs to be greater than or equal to the lowest feasible quality level $\underline{q}$, or the poorer farmer's endowment share s_1 to be greater than or equal to the threshold share s^* defined as

$$s^* = \{s_1 : \tilde{q}_1(s_1) = \underline{q}\}, \tag{7}$$

where $\tilde{q}_1(s_1)$ is the quality mapping from share s_1 to quality q_1 as found from (6), where s_2 is replaced with $S - s_1$.

Hence, in the event of an endowment split $s_1 < s^*$, the merchant does not serve the poorer farmer, but offers the first-best allocation to the richer farmer as in (3) and (4), thus, leaving the latter with no information rent.

Evolutionary fitness

As before, in game Γ^M it is the players' expected material payoffs—their evolutionary fitness—that define the equilibria of the game. Given a population distribution of subjective preferences F, the evolutionary fitness of a player of preference type $\tilde{s}$ is

$$\Pi^M(\tilde{s}) = 0.5Y(\tilde{s}) + 0.5E_{\tilde{s}' \in C(F)} Y(S - \tilde{s}'), \tag{8}$$

where $C(F)$ is the support of the distribution F, and E is the expectations operator, and Y is the indirect utility function, which maps a player's endowment share into the resultant material payoff accounting for the merchant's optimal play. In particular, a player's indirect utility Y of an endowment share s (with the other player's share being $S - s$) is defined by

$$Y(s) = \begin{cases} U^0(s) & \text{if} \quad s \leq S/2, \\ U^0(s) + U(q_2, s, p_2) & \text{if} \quad S/2 < s \leq S - s^*, \\ U^0(s) & \text{if} \quad S - s^* < s \leq S, \end{cases} \tag{9}$$

where (p_2, q_2) is the price-quality allocation aimed at the richer player (farmer) as defined above (which is itself a function of an endowment share s); and s^* is the threshold endowment share as in (7) that provides the condition when both farmers are served. A farmer obtains the highest evolutionary fitness Π^M when his indirect utility Y is maximized.

From function definition (9), we see that there is an upward shift $U(q_2, s, p_2)$ in the values of indirect utility function Y over $(S/2, S - s^*]$, which, otherwise, takes the form of reservation utility $U^0(s)$ only. As discussed above, when inequality in endowment distribution is not too sharp and because of which the merchant finds it optimal to serve both farmers, the richer farmer enjoys the information rent of $U(q_2, s, p_2)$, which is, otherwise, fully extracted by the merchant. Denote the maximizer of the function Y over the interval $(S/2, S - s^*]$ by $\bar{s}$. Since no information rents are available after the point $s = S - s^*$, which occurs when the merchant optimally shuts down on the poorer farmer, it is not clear where the function Y achieves its global maximum: at $s = \bar{s}$ or at $s = S$. In other words, it is not obvious from the material payoff perspective whether the dictator should keep all the endowment for himself (and maximize his reservation utility U^0) or give away the share $S - \bar{s}$ to the other farmer (and enjoy some information rent). It depends on the size of information rent, which, on the other hand, is dependent on the form of the utility functions. Formally, if

$$U^0(\bar{s}) + U(q_2, \bar{s}, p_2) > U^0(S),$$

or

$$U^G(q_2, \bar{s} - p_2) > U^0(S), \tag{10}$$

where (p_2, q_2) is the allocation aimed at the richer farmer for the endowment split $(\bar{s}, S-\bar{s})$, then the dictator attains the highest material payoff when he shares the endowment with the other farmer (by giving the latter $S - \bar{s}$). Intuitively, it is to require that farmers after a certain point become quickly satiated with the consumption of their own endowment (which is their land's produce) and value the outside good highly enough. (See the numerical example following this subsection that illustrates the points raised above.)

Returning to evolutionary fitness expression (8), we see that if condition (10) holds, the farmers of preference type $\tilde{s} = \bar{s}$ acquire the highest expected material payoff. In other words, when the farmers are exposed to external trades run by a monopolist merchant, inequity-averse preferences for money distribution can result in higher utility levels from consumption and, eventually, be favored by natural or cultural selection (to offset the merchant's monopoly power). All in all, the equilibrium split in game Γ^M is $(\bar{s}, S - \bar{s})$ when condition (10) holds; otherwise, it is $(S, 0)$.

Case 3: Perfect competition

Consider game Γ^C, where there are many competing merchants on the external market. Given that all merchants' profits have to be equal to 0 in perfect competition, the competitive solution to a merchant's problem is easy to describe. The level of quality offered has to be as in the first-best case, while the price has to be equal to the total cost of producing that particular quality. Therefore, the price-quality allocation (p_j, q_j) aimed at a farmer with an endowment share s_j is determined by (3) for the quality q_j, and the price is set by $p_j = C(q_j)$, which, unlike in the monopoly case, is not a function of the endowment share s_j. Therefore, the selfish farmers with $\tilde{s} = S$ attain the highest material payoff in game Γ^C, and this type of preference should survive evolutionary pressures.

Summary

The proposition below summarizes the resultant evolutionary stable preferences for the environments analyzed.

Proposition 1 *In the two-player dictator games with consumption studied above, Γ^A, Γ^M, and Γ^C, the evolutionary stable preference types $\tilde{s}_{es}$ with respect to endowment distribution are, respectively,*

- *in game Γ^A, autarky, — $\tilde{s}_{es} = S$;*
- *in game Γ^M, external trades run by a monopolist merchant, — if condition (10) holds, then $\tilde{s}_{es} = \bar{s}$, where $\bar{s} = \arg\max(Y(s) \mid S/2 < s \leq S - s^*)$ and the indirect utility function Y is defined by (9); otherwise, $\tilde{s}_{es} = S$; and*

- *in game Γ^C, external trades run by competitive merchants, — $\tilde{s}_{es} = S$.*

2.4 Numerical example

Here we illustrate the results obtained for the case with the monopolist merchant. Consider the following specification of the model. A farmer's reservation utility of his own endowment share $s \in [0, S]$ is given by $U^0(s) = s^a$, where $0 < a < 1$; the utility from the consumption of a (p, q) variety given a share s is $U^G(s - p, q) = (1 + q)(s - p)^a$, and we have that $U^G(s - 0, 0) \equiv U^0(s)$. The merchant's production function is given by $C(q) = q^b$, where $b > 1$, $q \geq \underline{q}$. Let the parameters take the following values: the endowment $S = 50$, the production parameters $b = 2$ and $\underline{q} = 0.01$, and we estimate the results for three different values of consumption utility parameter $a = 0.5, 0.7$, and 0.9 that capture different significance levels of endowment consumption for own material utility.

With the above specification of the model, a closed-form solution to the merchant's problem is all but impossible to obtain (this is why in the analytical part above we use a simplification that a farmer's net utility U is of the quasi-linear form in the price p). Instead, we revert to numerical methods to solve the model. Leaving aside the solution details[10], in Figure 1 below we present the results in the form of the plots of indirect utility function Y, (9). On the X axis, we have own endowment shares s, and on the Y axis we have the resultant utility levels Y given the merchant's optimal play. The three graphs plot the indirect utility levels for the three different consumption parameter a values. The coordinates of maximum points are given in bold that are contrasted with the coordinates of the other maximum candidate points. As we can see from the graph, when the value of a is not too high, i.e., when farmers do not value own produce too much relatively to the outside good, we have that farmers achieve the highest material utility by sharing with one another (see the plots for $a = 0.5$ and 0.7). In general, it can be shown that the lower the values the parameter a takes, the more farmers gain from sharing. The condition equivalent to (10)—when farmers are better off sharing with others—is that $a < 0.749$.

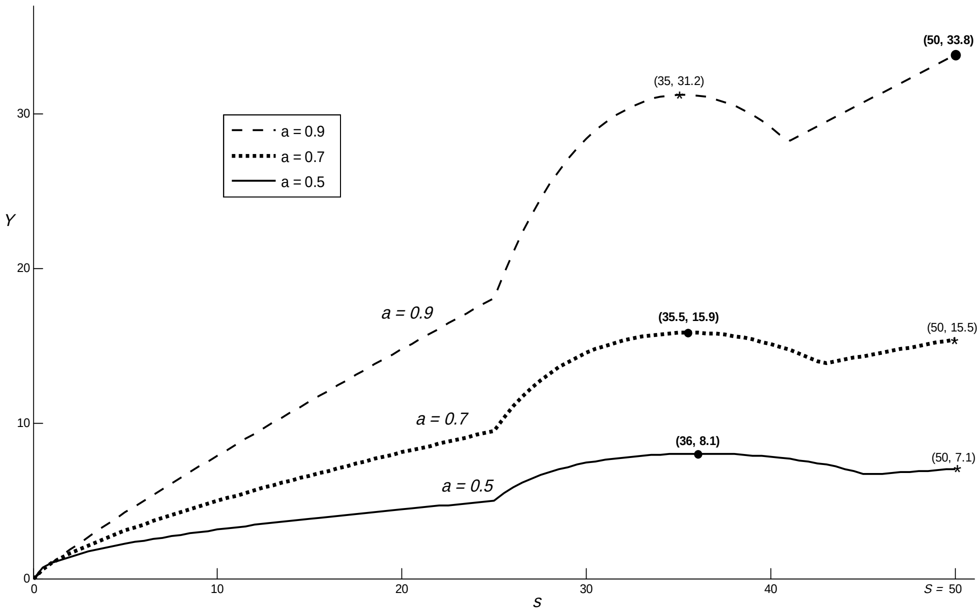
3 Discussion

3.1 Appearance and evolution of inequity aversion

The main result of Proposition 1 is that external factors, such as market exchange and market structure, can have an influence on people's behavior and the shape of their revealed preferences. In particular, besides genuinely altruistic considerations for other peo-

[10] The model was solved using Matlab and its function *fsolve* to solve systems of nonlinear equations.

Figure 1. Indirect Utility Function Y



ple (frequently adhered to when explaining experimental evidence on people's behavior, e.g., Levine (1998)), people may also develop inequity aversion toward money distribution as an optimal (i.e., own-consumption-maximizing) response to merchants' profit-seeking behavior. To put it differently, the results obtained here can also be interpreted as: *Even if* people are intrinsically selfish (with regard to their own consumption), they can still exhibit behavior as if they had inequity-averse preferences for money distribution. In other words, people's revealed preferences may only be an appearance of people's true nature as of under certain circumstances and, correspondingly, may be subject to change in response to changes in those circumstances (especially if we take the approach that behavioral traits are transmitted culturally, say, through enculturation, rather than genetically, see Cavalli-Sforza & Feldman (1981)). It is needless to say that the postulated superficial appearance of people's revealed preferences requires a very careful examination and discussion, but which is beyond the aim of this paper.

In the evolutionary literature, the group-selection argument is typically used to show how pro-social preferences can survive evolutionary pressures (see, e.g., Bergstrom (2002)). Unlike in standard models, our argument in favor of pro-social preferences does not hinge on the group-selection idea. Our explanation does not require that pro-social types of people, when matched with people like them, receive high enough payoffs to offset lower payoffs when matched with selfish types, thus, making their expected evolutionary fitness greater than that of the selfish types. Instead, our argument hinges on the idea that in order to subdue a third party's adverse impact people may be individually better off by choosing "pro-social" actions to the overall benefit of the group they belong to.

Needless to say, within the framework studied, other forms of evolutionary stable preferences could emerge depending on the degree of competition or monopoly on the market. A more general prediction would be that the more monopolist markets are, the less selfish people's preferences for money distribution should be, offering an empirically testable hypothesis on the link between market structure and people's preferences, which is left for future research. At the same time, there is empirical evidence in favor of the model, which is sketched in the following subsection.

3.2 Empirical evidence

In empirical studies, it has been demonstrated that people's preferences, revealed by their exhibited behavior in sharing money, are not uniform across different societies and are rather shaped by socioeconomic and cultural factors (see, e.g., Henrich *et al.* (2001); Henrich *et al.* (2004); Buchan *et al.* (2002); Herrmann *et al.* (2008)). As already noted in the introduction, the most compelling evidence in support of our theoretical findings comes from the project conducted in 15 small-scale traditional societies, which is documented in Henrich *et al.* (2001) and Henrich *et al.* (2004). The aim of this project was to look into the foundations of human sociality and its origins through studying small-scale societies, which could possibly shed light on the evolutionary transition of modern people's preferences (which are, actually, less diverse, see Roth *et al.* (1991)).

Henrich *et al.* (2004) found that people's preferences, revealed in playing the ultimatum, public good, and dictator games, differ across different groups, and that there are certain regularities in the documented differences. One of the regularities, relevant to our model, is that members of an isolated society behave less pro-socially than do members of a market-integrated society (as measured, primarily, by exposure to external market exchange). Henrich *et al.* (2004), however, provided no theoretical explanation for this important empirical finding, which is nonetheless fully in line with our theoretical predictions, presented in Proposition 1. As already been said, our explanation for this finding is that when people are exposed to external trades with merchants (who typically possess or collude to possess some monopoly power), they are better off by sharing with others since it overcomes merchants' full-rent extraction.

Certainly, to make this explanation more credible one would need to more closely explore the relationship between market structure and preferences as, for instance, hypothesized in the previous subsection.

3.3 Model extensions and research directions

Within a given society, the distribution of people's preferences is more diverse than just one type of preferences (see, e.g., Fehr & Schmidt (1999)). In our model—in particular, for game Γ^M with condition (10) being met—to achieve a non-trivial distribution of evolutionary stable preferences, we could elaborate by introducing a noisy signal that merchants receive about the income distribution resulting from an endowment split and depending on which they design consumption bundles. Then, due to the noisiness of a signal, there would be no single type of subjective preference that would be own-consumption maximizing for any realization of a signal. Instead, different types of subjective preference would be evolutionary-fitness maximizing for different realizations of a signal, leading, eventually, to a more diverse distribution of evolutionary stable preferences. Similarly, we could subject the structure of the external market to different competitive shocks, which would also lead to a more diverse distribution of evolutionary stable preferences.

In a similar fashion, we can think of other mechanisms affecting the form of revealed (inequity-averse) preferences. For instance, within our model, consider the effect on people's optimal (i.e., own-consumption-maximizing) behavior after the introduction of a uniform sales tax on the outside good. If the public authority aims to maximize tax revenues, then the model would predict people responding to the tax by reducing inequality in wealth on the grounds similar to the case with a monopolist merchant. On the other hand, if the tax imposed by the public authority is negligible, then it would not have any impact on people's behavior. In other words, the importance of the government's role in the economy can also shape the appearance of people's preferences, with its more central role adding to inequity aversion among people.

An interesting extension would also be to consider an N–player dictator game, where the number of farmers, matched to play the dictator game, is larger than two (similarly to the framework in Ok & Vega-Redondo (2001)). Qualitatively, it should not change the results: in certain cases, inequity-averse preferences should still render the highest material payoff. Interestingly, in game Γ^M it may not be optimal (from the material payoff perspective) for the dictator to split the remaining endowment evenly among the rest of the players, provided he finds it optimal to give away some of the endowment. Instead, the dictator can do better by dividing the remaining endowment unevenly as it can be seen from the special case of $N = 3$ and $V(q, s) = qs$, which at the same time poses an interesting question of what is the optimal income distribution from the dictator's perspective in the game with more than two players.

4 Concluding remarks

We have argued that the inequity-averse preferences of the type documented in laboratory experiments may be a product of natural or cultural selection. It has been shown that inequity aversion to money distribution can be developed as an optimal response to the surrounding socioeconomic environment—monopolistic merchandise markets, for instance.

The findings presented herein can be thought of as an attempt to reconcile experimental evidence on people's preferences for money distribution (or *subjective* preferences using the terminology of the paper) with the conventional modeling assumption about the own-regarding preferences underlying material utility (or *objective* preferences), which, as this paper shows, can be consistent with each other. To go further, this paper can also offer an additional insight into the problem of what preferences should be used in economic modeling. For instance, if we are to think that the (subjective) preferences revealed in experimental and field studies are reflective of more general behavioral traits, then in the partial-equilibrium or short-horizon analysis of decision making problems using the revealed (subjective) preferences would probably render more accurate predictions than would using the objective ones. However, if, for example, a modeled policy change has a substantial general equilibrium reach, then, along the lines of the model presented, it may also affect the form of people's subjective preferences through the social transmission of (more successful) behavioral traits. Then, using the subjective preferences to predict the long-run outcome of the modeled change would probably render less accurate results than would using the objective preferences.

Finally, to make the results of this paper more credible, more empirical research needs to be done on the interdependence between people's preferences and the environment they live in. In particular, one could examine the link between market concentration and people's preferences hypothesized here by regressing a market concentration index on a measure of inequity aversion across different countries.

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